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(54) METHOD FOR CONNECTING HEAT RESISTANT RESIN MOLDING TO METAL MEMBER AND ITS CONNECTED PRODUCT

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a method for rigidly thermally fusion bonding a heat resistant resin molding of a polyetherimide resin and a polyarylketone resin to a metal member while suppressing a large flow-out of a mixture resin composition and a connected product thereof.

SOLUTION: The method for connecting the heat resistant resin molding containing a resin composition including polyetherimide resin (A) and the polyarylketone resin (B) as a main component so that its mixing weight ratio is A/B=50 to 80/50 to 20 to the metal member by thermal fusion bonding is disclosed. In this case, the composition is thermally fusion bonded under temperature conditions of a thermally fusion bonding temperature set to a flow starting temperature (TA) or higher of the polyetherimide resin (A) and lower than a flow starting temperature (TB) of the polyarylketone resin (B) (where TB>TA).

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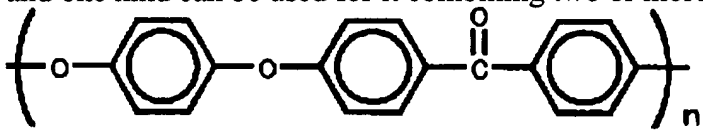
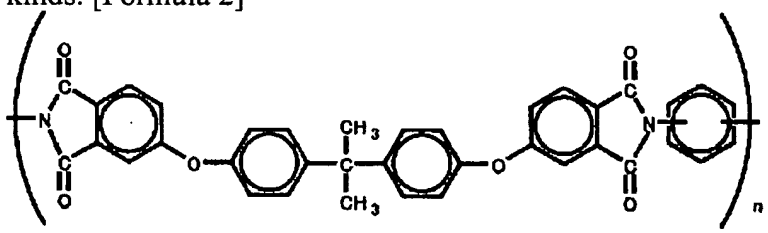
DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the approach of joining firmly the heat-resistant-resin Plastic solid which consists of mixed resin of polyetherimide resin and poly aryl ketone resin, and a metal body by thermal melting arrival, and its zygote.
[0002]
[Description of the Prior Art] Since it excels in thermal resistance, fire retardancy, hydrolysis-proof nature, chemical resistance, etc., many poly aryl ketone resin represented by polyether ether ketone resin is adopted centering on aircraft components, and the electrical and electric equipment and electronic parts. On the other hand, heat-resistant amelioration examination has been variously performed from poly aryl ketone resin having a glass transition temperature of the top where a raw material price is very expensive, and resin itself comparatively as low as about about 140-170 degrees C. As a system which shows good compatibility also in it, the blend with polyetherimide resin has attracted attention. A metal body is pasted up on the front face of the film fabricated by the components fabricated with injection molding by one of the applications which harnessed the description which was excellent in this blend system (it may be hereafter written as the poly aryl ketone system resin constituent), and extrusion molding with plating or adhesives, and there are some which are used as a mechanism element, or the electrical and electric equipment and electronic parts. For example, the tape carrier package tape which applies adhesives to the front face of the film which consists of polyether ketone resin, polyetherimide resin, and a minerals bulking agent, carries out laminating adhesion of the copper foil of a metal body, and forms a wiring circuit in JP,7-3446,B by etching is indicated. [0003] However, although the poly aryl ketone system resin constituent has the outstanding properties, such as thermal resistance and dielectric characteristics, when pasting up with adhesives the resin Plastic solid and metal body which were mentioned above, since the property of adhesives is inferior, the property of the pasted-up Plastic solid is spoiled greatly. Moreover, there was a problem that complicated processes, such as etching, were needed in plating. Various approaches which depend crystalline polymer and metal bodies, such as poly aryl ketone resin, neither on adhesion nor plating, but are joined by thermal melting arrival on the other hand are also examined. However, when the melting point and flow beginning temperature were exceeded, when not heated to the melting point, or the temperature near the flow beginning temperature beyond it, the adhesive property was hard to be acquired, in the case of crystalline polymer, it turned around, and resin was outflow-easy, floating deformation was carried out and there was [the configuration of a Plastic solid deformed substantially and] a trouble of resin overflowing into the perimeter of desired mold goods in it.
[0004]
[Problem(s) to be Solved by the Invention] The object of this invention is to offer the approach to which it is made to join firmly, and its zygote, controlling the large outflow of mixed resin for the heat-resistant-resin Plastic solid and metal body which consist of mixed resin of polyetherimide resin and poly aryl ketone resin.

[0005]
[Means for Solving the Problem] this invention persons came to complete a header and this invention for the junction approach of of the heat-resistant-resin Plastic solid and metal body which can solve the above-mentioned technical problem by using the heat-resistant-resin Plastic solid which consists of the polyetherimide resin and the poly aryl ketone resin of a specific presentation, and carrying out thermal melting arrival to a metal body in the specific temperature condition range, as a result of repeating examination wholeheartedly. Namely, the place made into the summary of this invention uses as a principal component the resin constituent which consists of polyetherimide resin (A) and poly aryl ketone resin (B). It is the approach of joining the heat-resistant-resin Plastic solid the mixed weight ratio of whose is A/B=50-80/20, and a metal body by thermal melting arrival. [50-20] It consists in the junction approach of of the heat-resistant-resin Plastic solid and metal body which are characterized by carrying out thermal melting arrival of the thermal melting arrival temperature more than the flow beginning temperature (TA) of polyetherimide resin (A) on the temperature conditions (however, TB>TA) of under the flow beginning temperature (TB) of poly aryl ketone resin (B). Moreover, in this invention, the zygote of the heat-resistant-resin Plastic solid and metal body which used the above-mentioned thermal melting arrival approach is also included. [0006]
[Embodiment of the Invention] Hereafter, this invention is explained in detail. This invention is the approach of carrying out thermal melting arrival of the heat-resistant-resin Plastic solid which consists of mixed resin which uses as a principal component the resin constituent which consists of polyetherimide resin (A) and poly aryl ketone resin (B), and the metal body more than the flow beginning temperature (TA) of polyetherimide resin (A) on the temperature conditions (however, TB>TA) of under the flow beginning temperature (TB) of poly aryl ketone resin (B). Here, the heat-resistant-resin Plastic solid which uses as a principal component the above-mentioned resin constituent used by this invention is fabricated by extrusion molding, injection molding, etc., and especially the condition (a crystal, semicrystalline, amorphism) of the crystal is not restricted. Especially a film and a sheet-like Plastic solid can be suitably used as a printed-circuit board excellent in thermal resistance, flexibility, dimensional accuracy, etc. by joining to metallic foils, such as copper foil, monolayer, or multilayer which is a metal body (laminating).
[0007] Although the polyetherimide resin which constitutes this invention is thermoplastics which includes nucleus association, ether linkage, and imide association in the structural unit and it is not restricted especially, in this invention, the amorphous polyether imide shown in the following structure expression (1) is used suitably. Specifically, it is marketed as the General Electric make, a trade name "Ultem1000", "Ultem CRS5001", etc. In addition, the polyetherimide resin to be used is independent and one kind can be used for it combining two or more kinds. [Formula 1]



[0008] Moreover, although poly aryl ketone resin is thermoplastics which includes nucleus association, ether linkage, and ketone association in the structural unit and there are a polyether ketone, a polyether ether ketone, a polyether ketone ketone, etc. as the example of representation, in this invention, the polyether ether ketone shown in the following structure expression (2) is used suitably. In addition, the poly aryl ketone resin to be used is independent, and one kind can be used for it combining two or more kinds. [Formula 2]



[0009] In this invention, it is important to perform the Plastic solid which consists of the above-mentioned mixed resin, and a metal body more than the flow beginning temperature (TA) of polyetherimide resin (A) on the temperature conditions (however, TB>TA) of under the flow beginning temperature (TB) of poly aryl ketone resin (B). A Plastic solid arises [here / this thermal melting arrival temperature becomes inadequate / under TA / bond strength with a metal body /, and / above TB / the problem of outflow, carrying out floating deformation, and the configuration of a Plastic solid deforming substantially or resin overflowing into the perimeter of desired mold goods / tend] on the other hand and is not desirable. In addition, the flow beginning temperature used in this invention is measured the following condition. That is, it measured on condition that programming-rate a part for /and load 3.92MPa (40 Kgf/cm2) of 3 degrees C using the nozzle with a bore [of 1mm], and a die length of 2mm with the "high-ized type flow tester CFT-500C mold" by Shimadzu Corp., and asked.
[0010] Moreover, in this invention, it is desirable from practical fields, such as a degree of freedom of temperature setting out, and the stability of bond strength, that 30 degrees C or more of differences of the flow beginning temperature (TA) of polyetherimide resin (A) and the flow beginning temperature (TB) of poly aryl ketone resin (B) are 50 degrees C or more more preferably. Furthermore, when you need the firmer bond strength of a Plastic solid and a metal body, it is desirable the range of more than TB-30 degree C and under TB and to set this thermal melting arrival temperature as the range under of TB beyond the extrapolation fusion initiation temperature (Tim) of a resin constituent especially. Here, extrapolation fusion initiation temperature (Tim) was measured based on JIS K7121 on the conditions whose amounts of samples are about 10mg and whose heating rates are a part for 10-degree-C/, and was searched for from the peak discovered to the highest temperature. In addition, extrapolation fusion initiation temperature (Tim) is shown as Onset temperature by "DSC-7" by PerkinElmer [, Inc.], Inc.
[0011] Moreover, when the mixed weight ratio of the heat-resistant-resin Plastic solid which consists of polyetherimide resin (A) applied to this invention and poly aryl ketone resin (B) makes the resin constituent which consists of A/B=50-80 / 50-20, i.e., polyetherimide resin (A) and poly aryl ketone resin (B), the 100 weight sections, polyetherimide resin (A) needs to be 50 - 80 weight section. It is [bond strength with polyetherimide resin (A) there are many resinous principles with flow beginning temperature high in under 50 weight sections, and sufficient / resinous principles / by the thermal melting arrival in the temperature conditions mentioned above here is hard to be obtained, and the resin constituent which constitutes a mixed resin Plastic solid flows out in the thermal melting arrival in the temperature conditions mentioned above when 80 weight sections were exceeded on the other hand, and] easy to carry out floating deformation and is not desirable. From this, the mixed weight ratios of the heat-resistant-resin Plastic solid which consists of more desirable polyetherimide resin (A) and poly aryl ketone resin (B) are A/B=50-70/30. [50-30] [0012] As for especially the crystal fusion peak temperature measured with the differential scanning calorimeter of poly aryl ketone resin (B) when applying this invention to members for electronics, such as a printed-circuit board, it is desirable from points, such as solder thermal resistance, that it is 260 degrees C or more. Moreover, as for the bond strength with electric conduction foils, such as copper foil, it is desirable from points, such as handling, and etching fitness, the dependability of the circuit board, that it is at least 0.6Ns/mm or more, and it is more desirable that it is 1.2Ns/mm or more. Other resin and various additives, for example, a filler, (an inorganic system, organic system), a thermostabilizer, an ultraviolet ray absorbent, light stabilizer, a nucleating additive, a coloring agent, lubricant, a flame retarder, etc. may be suitably blended with extent which does not spoil the property in the resin constituent which constitutes this invention.
[0013] When applying this invention to members for electronics, such as a printed-circuit board, especially, it is desirable to mix a filler and to raise dimensional stability. In this case, the amount of mixing of a filler has desirable 10 - 70 weight section to the resin constituent 100 weight section which consists of polyetherimide resin and poly aryl ketone resin. If a filler exceeds 70 weight sections here, since dynamics properties, such as impact strength of a mixed resin Plastic solid, fall, it is not desirable. Moreover, under in 10 weight sections, there cannot be little effectiveness of reducing coefficient of linear expansion and raising dimensional stability, or the improvement effectiveness of an elastic

modulus can seldom expect. It is [that the balance of mechanical strengths, such as 20 - 40 weight section then the flexibility of a film and **** reinforcement, and dimensional stability is compatible in the mixed range of a filler, and] desirable, when making this invention into a film configuration and applying to members for electronics, such as a printed-circuit board, especially.

[0014] Moreover, as a filler to be used, there is especially no limit and it can use a well-known thing. For example, fiber, such as inorganic fillers, such as talc, a mica, clay, glass, an alumina, a silica, alumimium nitride, and silicon nitride, a glass fiber, and an aramid fiber, is mentioned, and these are independent and can use one kind combining two or more kinds. Moreover, surface treatment, such as coupling agent processing of titanate etc., a fatty acid, resin acid, and various surfactant processings, may be performed to the filler to be used. When applying this invention to a printed-circuit board especially, the inorganic filler whose mean particle diameter is about 1-20 micrometers and whose average aspect ratio (particle size/thickness) is 20 to about 50 has the highly desirable effectiveness of raising dimensional stability, without reducing mechanical strengths, such as **** reinforcement.

[0015] Moreover, the mixed approach of various additives can use a well-known approach. For example, the masterbatch which mixed (a) various additives at high concentration (it is 3 - 60 % of the weight as a typical content) to suitable base resin, such as poly aryl ketone resin and/or polyetherimide resin, is produced separately. Concentration is adjusted to the resin which uses this, it mixes, and the approach of blending mechanically using a kneader, an extruder, etc., the approach of using a kneader, an extruder, etc. for the resin which carries out (b) activity, and blending direct various additives mechanically, etc. are mentioned. In the above-mentioned mixed approach, the masterbatch of (a) is produced and the approach of mixing is desirable from the point of dispersibility or workability.

[0016] Thus, size enlargement of the resin constituent which uses the obtained polyetherimide resin (A) and poly aryl ketone resin (B) as a principal component is thrown in and carried out to an extruding press machine or an injection molding machine. For the object which forms a printed-circuit board by thermal melting arrival with a metal body (foil) especially, it is desirable that they are a film or a sheet-like Plastic solid in respect of the handling nature etc., and it is more desirable that it is a film. Although a well-known approach, for example, the extrusion cast method, the calender method, etc. using a T die, can be adopted as the film production approach of a film or a sheet (it may only be hereafter written as a film) and it is not limited especially here, the extrusion cast method using fields, such as the film production nature of a film and stable productivity, to a T die is desirable. Although the molding temperature in the extrusion cast method using a T die is suitably adjusted by flowability, film production nature, etc. of a constituent, it is 430 degrees C or less more than the melting point in general. Moreover, the thickness of this film is usually about 10-500 micrometers. Furthermore, if needed, it may extend on two shafts or one shaft, or embossing, corona treatment, etc. may be suitably performed on the surface of a film for amelioration of handling nature etc.

[0017] Next, the manufacture approach of the zygote of the heat-resistant-resin Plastic solid of this invention and a metal body is explained. The approach of pressurizing a Plastic solid and a metal body with the press equipment set as the thermal melting arrival temperature requirement which mentioned above the manufacture approach by the thermal melting arrival of a heat-resistant-resin Plastic solid and a metal body, the approach of sticking by pressure the metal body heated in the thermal melting arrival temperature requirement beforehand mentioned above to a Plastic solid, the approach of pressurizing continuously the Plastic solid and the metallic foil of a film or a sheet configuration with the hot calender roll set as the thermal melting arrival temperature requirement mentioned above, etc. are mentioned. When producing a printed-circuit board with press equipment, it is the range of 0.98 - 9.8MPa (10 - 100 kg/cm2) extent by the planar pressure force, and when a press pressure is performed under reduced pressure of 973hPa (HEKUTOpascal) extent whenever [reduced pressure], it can prevent oxidation of a metallic foil and is desirable. Moreover, one side of a Plastic solid and a metal body may be joined (laminating), and even if each Plastic solid and metal body are a configuration to which one of the two or each both sides are joined (laminating), they are not cared about.

[0018] As a metal used for the metal body of this invention, these alloys, such as copper, silver, gold, iron, zinc, aluminum, magnesium, and nickel, are mentioned. These are independent and one kind can

be used for them combining two or more kinds. Furthermore, you may be the metal with which processing by the surface treatment, for example, the amino silane agent etc., of the range which does not bar this invention etc. was performed. The shape of a foil for forming a circuit as a configuration of a metal body by the thin line for forming the electrical and electric equipment besides the configuration as a structural member and an electronic circuitry or etching processing etc. is mentioned. In order to make heat dissipation into a key objective, aluminum is desirable, and in order to be complicated and detailed circuit formation, it is desirable that it is copper foil. In this case, what performed chemical conversion, such as black oxidation treatment, is suitably used in a front face. In order to heighten the adhesion effectiveness, as for a metal body, it is desirable to use what roughened beforehand the contact surface (field to pile up) side with a mixed resin Plastic solid chemically or mechanically. As an example of the copper foil by which surface roughening processing was carried out, in case electrolytic copper foil is manufactured, the roughening copper foil processed electrochemically is mentioned.

[0019]

[Example] Although an example explains this invention in more detail below, this invention does not receive a limit at all by these. In addition, the various measured value and assessment which are displayed into this description were performed as follows.

[0020] (1) It measured on condition that programming-rate a part for /and load 3.92MPa (40 Kgf/cm2) of 3 degrees C using the nozzle with a bore [of 1mm], and a die length of 2mm with the "high-ized type flow tester CFT-500C mold" by Shimadzu Corp. after drying the pellet of the raw material which carries out a flow-beginning-temperature activity. [0021] (2) According to JISK7121, it asked for about 10mg of samples using "DSC-7" by extrapolation fusion initiation temperature PerkinElmer, Inc. from the peak which measured the heating rate the condition for 10-degree-C/, and discovered it to the highest temperature. In addition, extrapolation fusion initiation temperature (Tim) is shown as Onset temperature by "DSC-7" by PerkinElmer [, Inc.], Inc.

[0022] (3) Bond strength JIS The ordinary state of C6481 tore off, based on strength, double-sided copper foil was measured, respectively and the average (n= 10) was displayed by N/mm. Moreover, bond strength wrote [the thing 1.2Ns //mm / or more] together (O) and a less than 0.6Ns [/mm] thing for (O) and a thing (0.6Ns [mm] /or more and less than 1.2Ns/mm) as (x). [0023] (4) From the film which carried out flow nature assessment crystallization processing, the test piece (configuration size: disk with a radius of 50mm) was cut down, it set to the two-sheet pile, and the heat press (pressure: 2.94MPa) was carried out for 30 minutes on the same temperature conditions as thermal melting arrival temperature with copper foil. The average (n= 5) of the maximum outer diameter of the obtained sample was calculated, the rate of increase to former size was computed as a rate of flow (%), and the rate of flow displayed (O), 0.5% or more, and less than 2% of thing for less than 0.5% of thing, and displayed (**) and 3% or more of thing for (O), 2% or more, and less than 3% of thing as (x). [0024] As shown in a table 1, the product made from polyether ether ketone resin [Victrex, (Example 1) PEEK381G, Tg:143 degree C, Tm:334 degree C, flow beginning temperature : 345.3 degrees C] (it may only be hereafter written as PEEK) 40 % of the weight, Amorphous polyetherimide resin [General Electric make, Ultem1000, Tg:216 degree C, Flow beginning temperature: The mixed constituent which consists of 272.7 degrees C] (it may only be hereafter written as PEI) 60 % of the weight was extruded with the laying temperature of 380 degrees C using the extruder equipped with the T die, and the film with a thickness of 75 micrometers was obtained. Subsequently, copper clad laminate was obtained by heat-treating by carrying out the laminating of the copper foil (thickness: 18 micrometers, surface surface roughening) to both sides of this crystallized film so that it may become an adhesion side about a roughening side, and carrying out a heat press (pressure: 2.94MPa) for 30 minutes at 330 degrees C. Assessment results, such as evaluated bond strength, are shown in a table 1.

[0025] (Example 2) As shown in a table 1, in the example 1, the aluminum tension laminate was obtained like the example 1 except having changed into the aluminum sheet (thickness: 100 micrometers) the metal body used for adhesion assessment from copper foil. Assessment results, such as evaluated bond strength, are shown in a table 1.

[0026] (Example 3) As shown in a table 1, in the example 1, copper clad laminate was obtained like the

example 1 except having changed the mixing ratio of PEEK to be used and PEI into 30 weight sections and 70 weight sections, respectively. Assessment results, such as evaluated bond strength, are shown in a table 1.

[0027] (Example 4) As shown in a table 1, in the example 3, copper clad laminate was obtained like the example 1 except having changed the thermal melting arrival temperature by the heat press into 310 degrees C. Assessment results, such as evaluated bond strength, are shown in a table 1.

[0028] (Example 5) As shown in a table 1, in the example 1, copper clad laminate was obtained like the example 1 except having mixed the commercial mica (mean particle diameter: 10-micrometer, aspect ratio:40) 30 weight section further to PEEK and PEI to be used. Assessment results, such as evaluated bond strength, are shown in a table 1. Moreover, there is especially no problem and by performing moisture absorption processing on the conditions of 121 degree-Cx100%RHx 48 hours, and immersing this copper clad laminate in a 260-degree C solder bath for 20 seconds after that using a pressure cooker testing machine, showed the good result, although viewing investigated generating of deformation, camber, interfacial peeling, etc.

[0029] (Example 1 of a comparison) As shown in a table 1, in the example 1, copper clad laminate was obtained like the example 1 except having changed the mixing ratio of PEEK to be used and PEI into the 100 weight sections and 0 weight section, respectively. Assessment results, such as evaluated bond strength, are shown in a table 1. In flow nature assessment, although the configuration was held and the good result was shown, the bond strength with copper foil exfoliated immediately that there is almost nothing. [0030] (Example 2 of a comparison) As shown in a table 1, in the example 1, copper clad laminate was obtained like the example 1 except having changed the mixing ratio of PEEK to be used and PEI into the 100 weight sections and 0 weight section, respectively, and having changed the thermal melting arrival temperature by the heat press into 350 degrees C further. Assessment results, such as evaluated bond strength, are shown in a table 1. Although the bond strength with copper foil showed the good result, in flow nature assessment, the flash of resin was observed for a while. [0031] (Example 3 of a comparison) As shown in a table 1, in the example 1, copper clad laminate was obtained like the example 1 except having changed the thermal melting arrival temperature by the heat press into 350 degrees C. Assessment results, such as evaluated bond strength, are shown in a table 1. Although the bond strength with copper foil showed the good result, the flow of large resin was observed in flow nature assessment. [0032] (Example 4 of a comparison) As shown in a table 1, in the example 1, copper clad laminate was obtained like the example 1 except having changed the mixing ratio of PEEK to be used and PEI into 60 weight sections and 40 weight sections, respectively. Assessment results, such as evaluated bond strength, are shown in a table 1. The flow nature assessment of the bond strength with copper foil was inadequate, although the configuration was held and the good result was shown. [0033] [A table 1]

表 1

	実施例					比較例			
	1	2	3	4	5	1	2	3	4
PEEK (重量部)	40	40	30	30	40	100	100	40	60
PEI (重量部)	60	60	70	70	60			60	40
マイカ (重量部)					30				
熱融着温度 (℃)	330	330	330	310	330	330	350	350	330
金属体の種類	銅箔	アルミ	銅箔	銅箔	銅箔	銅箔	銅箔	銅箔	銅箔
補外融解開始温度 (℃)	311.9	311.9	308.9	308.9	311.8	326.1	326.1	311.9	314.2
接着強度 (N／mm)	◎ 1.3	○ 1.0	◎ 1.6	○ 1.0	◎ 1.2	× 剥離	◎ 1.7	◎ 1.5	× 0.3
流れ率 (%)	○ 0.68	○ 0.68	○ 0.85	◎ 0.35	◎ 0.49	○ 0.18	△ 2.2	× 11.3	○ 0.59
総合評価	○	○	○	○	○	×	△	×	×

[0034] By the example 1 thru/or the thermal melting arrival approach of 5 in the range which has the presentation specified by this invention, and thermal melting arrival temperature with a metal body specifies from a table 1, it turns out that each flows with bond strength and it excels in the property of sexual [both]. on the other hand, a presentation -- differing (examples 1 and 4 of a comparison) -- thermal melting arrival temperature with a metal specifies -- being out of range (examples 2 and 3 of a comparison) -- when it is, it turns out that it flows with bond strength and is inferior to one of sexual properties.

[0035]

[Effect of the Invention] According to this invention, the heat-resistant-resin Plastic solid and metal body which consist of mixed resin of polyetherimide resin and poly aryl ketone resin can be firmly joined by thermal melting arrival, and the zygote (layered product) of various applications can be offered.

[Translation done.]

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CLAIMS

[Claim(s)]
[Claim 1] The resin constituent which consists of polyetherimide resin (A) and poly aryl ketone resin (B) is used as a principal component. It is the approach of joining the heat-resistant-resin Plastic solid the mixed weight ratio of whose is A/B=50-80/20, and a metal body by thermal melting arrival. [50-20] The junction approach of of the heat-resistant-resin Plastic solid and metal body which are characterized by carrying out thermal melting arrival of the thermal melting arrival temperature more than the flow beginning temperature (TA) of polyetherimide resin (A) on the temperature conditions (however, TB>TA) of under the flow beginning temperature (TB) of poly aryl ketone resin (B). [Claim 2] The junction approach of of the heat-resistant-resin Plastic solid and metal body according to claim 1 which are characterized by the difference of the flow beginning temperature (TA) of polyetherimide resin (A) and the flow beginning temperature (TB) of poly aryl ketone resin (B) being 30 degrees C or more. [Claim 3] The junction approach of of the heat-resistant-resin Plastic solid and metal body according to claim 1 which are characterized by carrying out thermal melting arrival of the thermal melting arrival temperature beyond the extrapolation fusion initiation temperature (JIS K7121) of a Plastic solid on the temperature conditions of under the flow beginning temperature (TB) of poly aryl ketone resin (B). [Claim 4] The junction approach of of the heat-resistant-resin Plastic solid of claim 1 **** 3 publication and metal body which are characterized by a Plastic solid being a film or a sheet.
[Claim 5] a Plastic solid and a metal body -- claim 1 **** 4 -- the zygote of the heat-resistant-resin Plastic solid and metal body which it comes to join by thermal melting arrival by the approach of a publication to either.
[Claim 6] The junction approach or zygote of the heat-resistant-resin Plastic solid of claim 1 **** 5 publication and metal body which are characterized by a metal body being copper foil by which surface roughening was carried out.
[Claim 7] The junction approach or zygote of the heat-resistant-resin Plastic solid of claim 1 **** 5 publication and metal body which are characterized by a metal body consisting of aluminum.

[Translation done.]